

A NEW DIPLOCARDIAN EARTHWORM FROM ILLINOIS
(OLIGOCHAETA: MEGASCOLECIDAE)

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The species to be described here was discovered by Mr. James H. Stebbings and, at his request, is named in honor of Professor J. W. Conoyer, St. Louis University. The collection site is described by Mr. Stebbings as follows: (in manuscript)

T2N, R8W, Section 21, St. Clair Co., Illinois. Drained by Canteen Creek, a small tributary of the Mississippi. Soil: Stookey silt loam (loessial), a soil developing on 7-15% slopes; immature Ava silt loam may be present if slope is under 7%. A₁ horizon apparent only under stable oak or elm forest. Forest; oak-hickory climax present on some slopes, sub-climax on many, sometimes dominated by large elms. Hilltops grass.

The collections were made in April and May, 1960. The material available for the following diagnosis included 14 clitellate specimens. Syntypes have been placed in the U. S. National Museum, Catalog Number 30394.

Diplocardia conoyeri n. sp.

Unpigmented (alcoholic specimens). Size, 94 to 130 by 1.7 to 2.8 mm, with averages of 116 by 2.3 mm for length and width respectively (14 clitellate specimens). Somites, 125 to 143, average 136. Form rather elongate, tapering anterior to VII, posterior end only slightly swollen. Prostomium, broad, blunt, pro-epilobic. Secondary annulations very weak. First dorsal pore 11/12. Anus terminal. Setal formula (in segment X), **aa:ab:bc:cd**: = 3:1:2:1; dd = 6aa. Clitellum XIV to XVIII, incomplete ventro-medially. Tubercula pubertatis absent. Genital tumescences, median, unpaired over 17/18 and 20/21. Spermathecal pores presetal in VIII and IX in setal line **a**; pores in VIII on anterior edge of segment, pores of IX located anterior to **a** distance equal to **ab**. Spermathecal setae not differentiated. Male field elongate, slightly raised area including XVIII to XX. Seminal gutters lunate, in setal line **ab**, from ½ XVIII to ½ XX; greatest width equals **ab**. Prostate pores at ends of gutters in XVIII and XX. Setae **ab** of XVIII and XX modified as genital setae; 1.5 x 0.01 mm in length and width; curved, with fine teeth near pointed distal end. Male pores paired on small papillae, anterior portion of XIX, in seminal gutters. Female pores, paired, anteromedial to **a**, on a transverse glandular area of segment XIV. Nephrophores in setae line **d** at anterior edge of segment.

Pharyngeal gland masses ending in IV. Gizzards in V and VI. Esophagus without distinct caliciferous gland; esophageal lumen in VII and VIII with ridged walls of columnar cells with numerous gland cells; from IX to XII, inner walls distinctly papillose, discontinuously ciliated on free ends of papillae; from XIII to ½ XVI, lumen strongly ridged with high ciliated columnar cells. Intestine expands in XVII. Typhlosole begins in XX, ends **ca** LXXV.

Last heart in XII. Subneural vessel absent. Dorsal vessel generally single, possible doubling in XIV (XII, XV?). Testes large, manicate, from antero-ventral wall of X and XI. Sperm duct without epididymal looping; ducts on coelomic surface of parietes, joining in XVIII. Ovaries large, with multiple strands of ova, from antero-ventral wall of XIII. Ovisacs present. Ovarian funnel auriculate; oviduct direct. Seminal vesicles rather small, incised, from 9/10 and 11/12 in IX and XII. Seminal receptacles in VIII and IX; ampulla about same length as duct; elongate diverticulum opening on ento-lateral portion of duct; duct wall enlarged with definite crypt opening below diverticular stalk. Prostates two pair, opening in VIII and XX; short, narrowed duct joins gland proper in segment behind pore; glandular portion of prostate considerably longer than duct, extending through a variable number of segments (2 to 5). Regular setae unmodified. Meganephridial, avesculate. Septa 7/8, 8/9, and 9/10 thickened; 6/7, 10/11, and 11/12 somewhat thickened.

DISCUSSION

Three species, *Diplocardia smithii* Macnab and McKey-Fender 1955, *D. udei* Eisen 1899, and *D. gracilis* Gates 1943, resemble *D. conoyeri* in: (1) location of last hearts in XII, (2) quadrithecate condition, and (3) single dorsal vessel. In the pattern of genital markings, disposition of the spermathecal pores, and structure of the penial setae, *D. conoyeri* differs from all of these species. Furthermore, it may be distinguished from *D. udei* and *D. gracilis* on the structure of the prostate glands and from *smithii* on the basis of the form of the spermathecae as well as the degree of typhlosolar development.

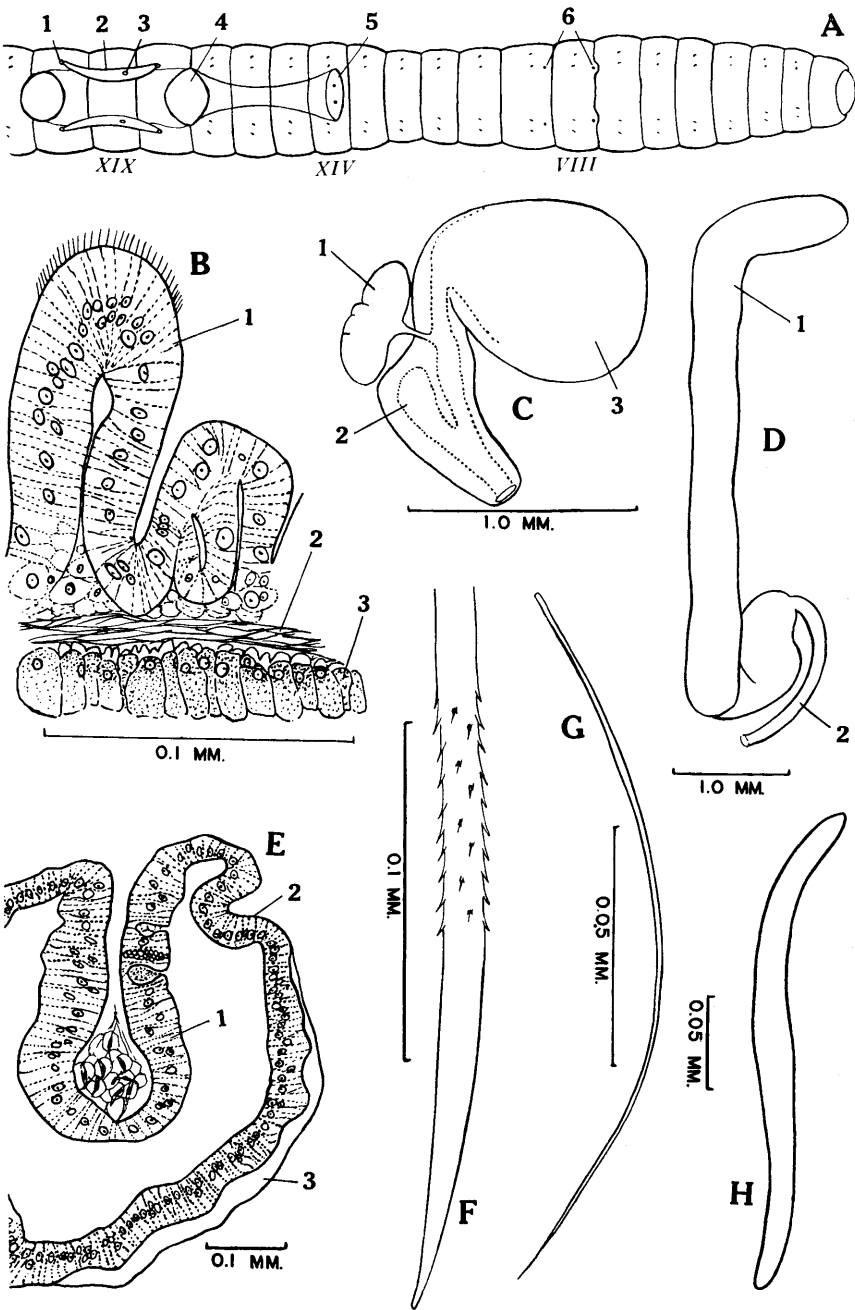
In those specimens of *D. conoyeri* at hand, the body wall is so transparent that it is possible to see the internal organs; particularly in the post-clitellar region; this may be the result of the method of fixation and subsequent storage in alcohol. The clitellum passes ventro-medially almost to the midline, leaving a narrow, median gland-free area which widens to *aa* on XIV and XVIII (fig. 1A). The posterior pair of spermathecal pores is displaced toward the equator of IX while those of VIII remain near the intersegmental furrow $\frac{1}{8}$. A variation was noted in one specimen in which the anterior spermathecal pore of one side was displaced slightly posteriad on VIII.

Genital tumescences are reduced in *D. conoyeri* to unpaired median papillae across the intersegmental furrows 17/18 and 20/21. These are flattish areas, somewhat transverse, with distinct margins (fig. 1A-4). The lunate seminal gutters (fig. 1A-2) are open, possibly due to the state of fixation. Characteristically, setae *ab* of XIX are missing.

Regional differences in the esophageal region are essentially confined to the epithelial layers. In VII and VIII, "goblet-cell" types are found in the compact, non-ciliated columnar cell layer. The lumen is regular with low papillae arranged in rows. From IX through XIV, the epithelial wall is rugose because the epithelium is thrown into folds, locally separated from the muscular coat (fig. 1-B). These papillae are irregularly spaced and bear patches of cilia on their free surface. The papillae are lower or absent in XIV- $\frac{1}{2}$ XV, at which point the epithelium changes abruptly, the cells becoming higher, closely packed, and heavily ciliated. The lining of $\frac{1}{2}$ XV-XVII is ridged longitudinally, much after the fashion of a

EXPLANATION OF FIGURE 1

- A. Diagram of the ventral aspect of *D. conoyeri*.
 1. Prostatic pore of XX.
 2. Seminal gutter.
 3. Spermiducal pore.
 4. Tumescence of 17/18.
 5. Glandular field surrounding female pores.
 6. Spermathecal pores.
- B. Portion of esophageal wall in segment XI.
 1. Columnar epithelium.
 2. Muscular layer.
 3. Chloragogue layer.
- C. Spermatheca of segment IX.
 1. Diverticulum.
 2. Crypt.
 3. Ampulla.
- D. Prostate gland of segment XX.
 1. Glandular portion.
 2. Duct.
- E. Section of intestine in segment XXI.
 1. Typhlosolar epithelium.
 2. Intestinal wall.
 3. Intestinal blood sinus.
- F. Distal portion of penial seta; segment XX.
- G. Penial seta of segment XX.
- H. Seta of spermathecal segment VIII.



calciferous gland although the lamellae are quite low and give no hint of coalescence. A valvular structure is located at 16/17, beyond which the gut expands into the intestine proper, with a lining of low, non-ciliated columnar cells.

The dorsal vessel is generally simplex with the only apparent doubling in XIV. In XIII and XV, however, the vessel is flat and may appear, or actually be, doubled in one or both of these segments. I could not identify a supra-esophageal vessel.

The posterior spermathecae are slightly larger than those of VIII. The ampulla is rather cordate and larger than the duct. Bending of the ampulla on the duct as figured (fig. 1C), cannot be considered diagnostic as it does not always occur. Each spermathecae consists of four parts: (1) duct, (2) ampulla, (3) diverticulum, and (4) crypt. The diverticulum opens to the anterior or antero-lateral face of the duct near the ampulla. Ectally, the duct broadens, forming a shelf beneath the diverticulum. This protuberance contains an outpocketing of the duct lumen, which I have designated as a *crypt*. The structure is not unique to *D. conoyeri*; Gates, (1943) in describing *Diplocardia ornata*, has written: "... on the anterior face of the duct near the ampulla is a thick-walled, hemispheroidal protuberance which is continued ectally for a short distance within the wall of the duct and finally opening into the duct lumen." He continues his description, noting the presence of a "diverticulum," lateral or meso-lateral to the "protuberance" as described.

In *D. conoyeri*, the epithelial lining of the spermathecal complex is differentiated into three general regions. The duct and crypt form one region with high columnar cells, closely packed and without cilia. The ampulla is lined with columnar cells, ciliated except in the region of the juncture with the duct. The epithelium of the diverticulum is less regular; the cells appear almost cuboidal, and, as in duct and crypt, are not ciliated. In mature worms, the diverticulum is packed with sperm; the ampulla, duct, and crypt may contain a few widely distributed sperm cells.

The prostate glands each occupy more than one segment. Those of the anterior pair are more tightly coiled, involving at most three segments; the posterior pair may extend backward into XXV. The short muscular duct joins the glandular portion (fig. 1D) after penetration of the septum behind the prostatic pore. The gland may then extend directly back through successive segments or fold upon itself variously. The ectal portion of the duct passes through the body wall just lateral to the setal couple *ab* of XVIII and XX. These setae are 1.5 x 0.01 mm in length and width, nearly contiguous within the body wall, arciform, and finely-toothed distally (figs. F and G). Their follicles are quite long, passing through two post-prostatic segments to join the lateral body wall; those of XVIII reaching 20/21, of XX, to 22/23.

Two anatomical notes of some interest relate to the analysis of *D. conoyeri*. In the coelomic cavity of segment VIII, ventro-lateral to the gut, there are strands of gland cells, which, in staining reaction and form, appear to be of the same type as those found in the pharyngeal gland mass. Constancy in this structure should be looked for in other diplocardians.

The ovisac of one worm contains an ovum in metaphase; the centriole is eccentric. A similar condition is known in the Lumbricidae (Stephenson, 1930; p. 460), wherein it is suggested that the metaphasic stage obtains at the time of oviposition. Although the male funnel bears some iridescence indicating possible biparental reproduction, no other information is available on the life history of *D. conoyeri*.

The laboratory study of this material has been accomplished during the tenure of NSF Grant 6378.

LITERATURE CITED

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